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Collecting empires: Dominik Bilimek and early subterranean zoology between politics and field research

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Abstract

The Moravian Cistercian monk and collector Dominik Bilimek (1813–1884) is considered one of the earliest European naturalists to conduct zoological research on subterranean fauna in Latin America. During the second French invasion of Mexico, from 1861 to 1867, he accompanied Maximilian of Habsburg, the newly enthroned emperor of Mexico, to the region. There, he explored the Grutas de Cacahuamilpa near Taxco de Alarcón, comparing its fauna to his earlier discoveries in Postojnska jama in Carniola (Slovenia). After the victory of the Mexican republican forces and Maximilian's execution, Bilimek retained his role as curator of the emperor's collections, which he took back with him to Europe and exhibited at Miramare Castle near Trieste. Prior to his Mexican venture, Bilimek had embraced the imperial goals and intellectual agendas of the Viennese central administration while teaching at the monarchy's military institutes. Following the revolutions of 1848/49, extensive research undertakings—including geoscientific, biological, and archaeological surveys—were initiated to preserve the Habsburg monarchy as a supranational entity amidst internal and external crises, and to legitimize its territorial framework as both a natural and cultural unit. These developments coincided with the initial surge of zoological interest in Carniolan caves, which spurred efforts to gather similar findings in other karst regions of the monarchy. Drawing on historical sources, this article explores the intersection of political concepts and fieldwork practices in the early study of cave biology. Special attention is given to the sites, networks, and modes of collecting during this transformative period.

Keywords

Bilimek, cave fauna, collecting, entomology, Habsburg monarchy, history of zoology, Mexico

Introduction

> My companion, endowed with an entomological instinct, meticulously explored every crevice [of Koblarska jama in Slovenia] where insects might hide. His perseverance was richly rewarded when he discovered, beneath scattered rocks, the eyeless cave beetle *Anophthalmus schmidti*. It was first identified by the eminent Carniolan entomologist, Ferdinand Schmidt, initially in Predjama and later in another cave on Mount Krim in Carniola, always in very limited numbers. Thus, [my companion] found the third known location of this beetle and, to his indescribable delight, captured 14 specimens. Two of them are now preserved in the Imperial Collections in Vienna (Skofitz 1847: 218, translated from German by me).

The lucky finder was none other than the Cistercian monk Dominik Bilimek, a notable naturalist and avid collector who made significant contributions to cave entomology in the 1850s and 1860s. Beginning with the earliest discovery of a cave-dwelling insect in Postojna jama in 1832, the search for these specimens over the next two decades would focus mainly on the karst area between Ljubljana and Trieste. These efforts were driven primarily not only by learned communities within the Habsburg monarchy but also by individual foreign scholars. Through comparative observations, these scientists and collectors formulated initial hypotheses about the interdependence of cave specimens and their unique ecosystems.

This article explores the political and social landscapes that fostered the emergence of subterranean zoology within and beyond the Habsburg monarchy, examining how these frameworks shaped research agendas and practices. Approaching the topic from a history of science perspective, I draw on the valuable works of Bellés (1992), Juberthie (2005), Negrea (2007), and Romero (2009), who explored the history of cave biology through the lens of specialty formation and scientific ideas, as well as specific regions like France and the Balkan Peninsula. Considerable attention has been paid previously to the Romanian zoologist and explorer Emil Racoviță (1868–1947), whose influential manifesto "Essai sur les problèmes biospéologiques" (Essay on biospeological problems, 1907) synthesized extant knowledge on the origin and evolution of subterranean fauna and coined the term "biospéologie" (now biospeleology) (Vandel 1964; Tabacaru and Danielopol 2020; Culver and Pipan 2023). Notably, Christian (2003) and Polak (2005) provided comprehensive accounts of nascent cave entomology in both Austria and Slovenia, thereby situating these endeavors within the burgeoning international context.

Bilimek, who has recently gained attention in museological and postcolonial scholarship (Bueno Bravo 2013; Lukeneder et al. 2023) because of his controversial activities as a collector of pre-Columbian artifacts during his stay in Mexico, serves as a pertinent case study for two reasons. First, Bilimek's approach mirrors the established traits of many of his mid-nineteenth-century European naturalist contemporaries studying (cave) fauna: transdisciplinary curiosity, meticulous fieldwork rooted in a penchant for collecting and the notion of orderliness, and extensive networks for exchanging specimens (Kohler 2006). Second, Bilimek's exceptional global scale of operations,

facilitated by imperial power relations, and his integration into Vienna's local scientific communities provide avenues for exploring both the methodological and sociopolitical dimensions of early studies in cave biology.

This article argues for a deeper consideration of geopolitical agendas and scholarly exchange in the development of knowledge about subterranean organisms and its emergence as a distinct field of study in the nineteenth century, later defined and systematized by Racoviță and his French collaborator René Jeannel (1879–1965). My essay seeks to shift the understanding of these early steps by viewing them not only as the achievement of a few "professional" scientists but also as a collaborative effort of diverse local, regional, and (trans)national practitioners motivated both by the prospect of public benefit and the hope for personal gain. Based on a (re-)evaluation of published and archival historical sources on cave fauna in the Habsburg monarchy, I will examine the changing conditions, goals, and profit expectations that motivated various stakeholders to engage in cave entomology; the resources they tapped; and the (collaborative) practices they developed. A key focus will be on Bilimek's role, the methods he employed, and the impact of his international ventures. I will assess how these factors shaped the emergence of subterranean zoology, considering the influence of the increasing specialization and imperial-colonial dynamics extant at that juncture. To this end, I will first introduce Bilimek as a scientific collector, highlighting his lesser-known interest in cave fauna. I will then analyze how the study of cave specimens developed under the Habsburg monarchy and conclude with Bilimek's exploration of Mexican caves and his comparative approach.

Dominik Bilimek: Collector and early cave biologist

The second son of a German-speaking butcher in the small Moravian town of Nový Jičín (Neu Titschein, today in the Czech Republic), Bilimek entered the Cistercian monastery of Neukloster in Wiener Neustadt after completing his schooling (Fig. 1). While serving in the monastery's scientific cabinet, he cultivated a deep interest in natural history and antiquarianism. He was ordained a priest in 1837 (Roth 2004). In the course of his subsequent pastoral duties, Bilimek undertook numerous excursions into the nearby mountains of Lower Austria, particularly the Schneeberg and the Raxalpe, which he is reported to have climbed more than a hundred times (Moser 2008). His passion gradually extended beyond the local flora to encompass the systematic study of phanerogams and insects. From 1844 onward, Bilimek's explorations took him to the Adriatic coast and Hungary, where he collected the fauna and flora of Lake Balaton and the karst of the Bakony Mountains.

In the later stages of his career, Bilimek was employed as a professor of natural history and theology at the Convent School in Wiener Neustadt and at various military educational institutions, including the Cadet Institutes in Hainburg, Łobzów (Krakow), and Eisenstadt and the Military Academy in Wiener Neustadt (Roth 1965). While in post, he curated extensive teaching collections there and maintained close

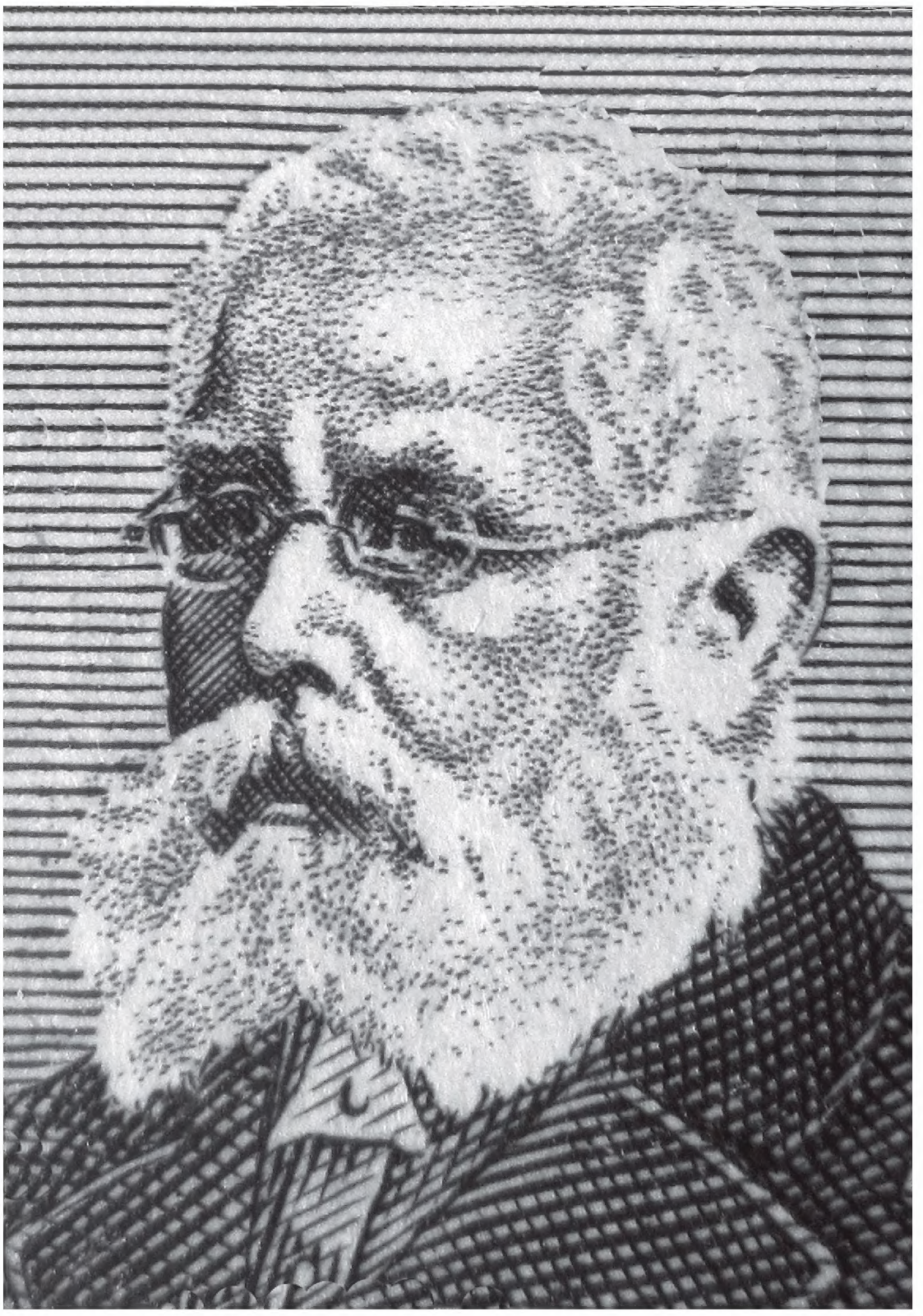

Figure 1. Lithograph of the elderly Dominik Bilimek (1813–1884), curator of the Imperial Mexican Collection at Miramare Castle near Trieste. Source: Monastery Archive Heiligenkreuz (Lower Austria).

contact with Vienna's emergent learned societies and prominent scientists, such as the geologists Dionýs Štúr (1827–1893) and Eduard Suess (1831–1914). Bilimek also expanded his interests to study cryptogam flora, paleontology, and classical antiquity, engaging in excavations and collecting artifacts in the former Roman town of Carnuntum in Lower Austria (Mader 2002).

In 1865, Bilimek entered the service of the Habsburg Archduke Ferdinand Maximilian (1832–1867), who had taken the Mexican crown as Emperor Maximilian I amid the second French invasion of Mexico. On his arrival in the Americas, Bilimek was appointed curator of the Imperial Mexican Museum at Chapultepec Castle in

Mexico City (Riedl-Dorn 2001). Modeled on the Vienna Imperial Collections, this museum and other learned institutions founded by Maximilian, such as the Mexican Academy of Sciences and Literature, emulated their Austrian equivalents (Azuela et al. 2009). During his two-year tenure in Chapultepec, Bilimek traveled to the nearby Querétaro region and the central highlands, buying, collecting, or simply taking numerous natural history specimens and unique ethnographic objects. Bilimek also took some pre-Columbian artifacts from culturally significant caves, for example, those near the town of Orizaba in Veracruz (Bilimek 1878). Following the execution of Emperor Maximilian in 1867, Bilimek managed to save himself and arranged the transport of the extensive Mexican collections to Europe. Today, in light of postcolonial reconciliation measures, his actions are viewed under a critical light (Bueno Bravo 2013; Schönberger 2021). Bilimek continued his stewardship as curator of the imperial collections exhibited at Miramare Castle near Trieste. In subsequent years, he traveled extensively to North Africa and Palestine to enhance the collections further. Once the Mexican specimens and antiques were finally transferred to Viennese museums, particularly to the anthropological–ethnographic collections of the Natural History Museum (1877–78), Bilimek successfully negotiated a pension for himself. This arrangement allowed him to settle in the capital with his housekeeper, thereby avoiding a return to the monastery of Heiligenkreuz (Roth 1965; Lukeneder et al. 2023).

A lesser-known aspect of Bilimek's multifaceted biography, shaped by the imperial politics of the time, was his profound interest in caves and karst. Raised during a period when research in subterranean zoology was just gaining momentum with the first descriptions of cave fauna, Bilimek and his fellow collectors placed special emphasis on underground habitats (Christian 2003). This trend was especially pronounced in the Habsburg crown lands, notably in Carniola, where in the first half of the nineteenth century, a lively commerce in the aquatic salamander *Proteus anguinus* had originated (Mattes 2018; Aljančič 2019) and cave-dwelling insects were first discovered. These included the cave beetle *Leptodirus hochenwartii* Schmidt, 1832, the cave cricket *Troglophilus cavicola* Kollar, 1833, and the blind cave ground beetle *Anophthalmus schmidtii* Sturm, 1844. As a result, starting from the 1840s, caves around Postojna became frequent destinations for naturalists, not only for study but also because cave insects had significant exchange value, leading to a robust trade among collectors (Polak 2005; Zagmajster et al. 2021).

At the time of his trip to Lower Austria and his journey to the Bakony Mountains in Hungary, Bilimek probably explored caves, although published records of these expeditions are scarce. There are references to his 1846 trip to Carniola and the Austrian Littoral, jointly undertaken with the botanist and pharmacist Alexander Skofitz (1847), founder of the Vienna Botanical Exchange Society (*Botanischer Tauschverein*) and the Austrian Botanical Weekly (*Österreichisches Botanisches Wochenblatt*). It was during this expedition that Bilimek focused on collecting cave insects, including the first specimen of the cave beetle *Typhlotrechus bilimeki* Sturm, 1847, which he found in Željnske jame. Additional collecting trips took Bilimek to the Drachenhöhle near Mixnitz (Styria) and into the Moravian Karst (Lukeneder et al. 2023). Despite his

contributions, Bilimek did not enjoy widespread recognition as a scientist because of his lack of formal academic training and limited publication record, as well as the transdisciplinary approach he adopted. While he was probably one of the first Europeans to investigate cave-dwelling organisms in Latin America, Bilimek (1867) published only a single, concise article during his lifetime, describing his study of the Grutas de Cacahuamilpa in Mexico. From the 1860s onward, the trend toward specialization and discipline-specific research set boundaries that gradually pushed naturalists, collectors, and patrons to the margins of scientific knowledge production.

To understand the collecting practices of Bilimek and his fellow naturalists, they must be located within a larger societal context. Collecting was not just a passion; it was a crucial method of appropriating nature and, arguably, the most important way to study the natural world at that time (Heesen and Spary 2001; Kohler 2002). The compilation, completion, and systematic ordering of specimens not only made knowledge about the world more accessible but also transformed natural history cabinets into microcosms of the world itself and the unity of knowledge about it (Findlen 1996). In the Habsburg monarchy, natural research was closely associated with aristocratic demands for prestige and representation. Many naturalists, like Bilimek, pursued their scientific interests alongside civil service duties, thereby endowing collecting with significant political implications (Raffler 2007; Rampley et al. 2021). By the latter half of the nineteenth century, the exploitation of the empire's natural resources, the centralization of specimens (both domestic and overseas) in collections in capital cities, and their public display became integral to imperial discourse (Gahtan and Troelenberg 2006; Habermas and Przyrembel 2013). This aspect will be explored further in the following section.

Imperial politics, troglobites, and the k. k. Zoological-Botanical Society of Vienna

The multinational Habsburg monarchy, Europe's second largest state after Russia at the time, was a complex mosaic of diverse territories and cultures stretching from the Alps to the Balkans and the Adriatic to the Carpathians. In contemporary travel reports, learned journals, and descriptions of the empire's natural wonders published in the early nineteenth century, mountains, caves, and other underground sites were often highlighted (Sartori 1807–1809; Pichler 1809; Salm-Reifferscheidt 1814; Costa 1820). The newly established provincial museums (*Landesmuseen*) in the crown lands, beginning with the Joanneum in Graz in 1811, specially focused on these previously unexplored sites and their natural wealth when building their collections (Južnič 2006; Pakesch and Muchitsch 2011). Caves, in particular, came to symbolize regional identity in the Habsburg territories, most notably in Carniola, Hungary, and Moravia. As a result, the earliest descriptions of karst areas and their caves often featured detailed descriptions of the history and culture of the respective crown land (Hohenwart 1830–1832; Vass 1831).

Habsburg policymakers viewed state unity and regional identity not as contradictory but rather as complementary. They aimed to foster "unity in diversity," a slogan marking the deliberate recognition of the empire's natural and cultural diversity (Ash and Surman 2012; Feichtinger and Uhl 2016; Coen 2018). This approach included the state authorities' expressed interest in the exploration, development, and use of caves and other underground sites for touristic, economic and illustrative purposes. When members of the imperial family or the high aristocracy paid an official visit to a crown land, caves often featured prominently on their itinerary. For instance, Emperor Franz (1768–1835) visited the Moravian Karst in 1804 and the Carniolan Karst in 1818, and Crown Prince Ferdinand (1793–1875) toured the Aggtelek Karst (Hungary) in 1811. Infrastructure improvements, such as new paths and lighting, were often made to facilitate these visits and, occasionally, led to the discovery of previously unknown passages (Shaw 2008). As a result, several caves or sections of them explored in the nineteenth century were named after members of the imperial family. In the case of Postojnska jama, certain sections were dedicated to significant landmarks along the road between Vienna and Carniola (Shaw 2006).

In 1824, Postojnska jama came to be officially supervised with the establishment of the k. k. (imperial–royal) Cave Management (*Grottenverwaltung*) and the introduction of regular guided tours (Vekar 1989). This marked an important point in the management of the monarchy's natural heritage, especially its underground treasures, and it had a profound effect on public perceptions of Postojnska jama. Its fame spread far and wide through its inclusion in guidebooks, on postcards, on school wall maps, and the inclusion of specimens in natural history collections, contributing to its reputation as the "foremost among its sister [caves] in the empire" (Schaffenrath 1834; Schmidl 1854: 39; Radics 1861). Over the following years, Postojnska jama became the archetype of an "imperial" grotto par excellence (Fig. 2). Because of its status, other well-known caves throughout the monarchy, such as Baradla-barlang in Aggtelek (Hungary), Jama Vilenica in Lokev (Austrian Littoral), or Sloupsko-šošůvské jeskyně near Blansko (Moravia), were often compared to Postojnska jama (Mattes 2015; Shaw and Čuk 2015). Adolf Schmidl (1802–1863), an official of the Imperial Academy of Sciences in Vienna, toured the principal karst regions of the Habsburg monarchy, documenting their unique characteristics and similarities in scientific publications, guidebooks, and newspaper articles. Schmidl's (1863: 270) comprehensive studies led him to argue that all "Austrian caves," around 200 were known at the time, should be officially "recognized as the property of the crown lands" and administered by the salient provincial assembly (*Landtag*). He passionately campaigned for the preservation, maintenance and equal recognition of these caves, similar to Postojnska jama.

After the revolutions of 1848/49, the Habsburg central administration promoted the formation of scientific societies in Vienna, particularly in fields, such as biology and geography, not addressed by the few state-run research facilities. These private societies, comprising up to 2,000 members from across the empire and abroad, including aristocrats, scholars, bureaucrats, teachers, and military officers, saw themselves as extensions of existing state institutions (Mattes 2024). They played crucial roles as symbols of the

Figure 2. View of "Calvary Mountain" in Postojnska jama, 1864. Artist: Franz von Kurz zum Thurn und Goldenstein. Source: National Museum of Slovenia.

monarchy's unity and sought to thereby mitigate national tensions. To this end, the societies undertook large-scale cooperative projects that defined the state territory as a natural and cultural unit. One notable institution was the k. k. Zoological-Botanical Society, founded in 1851 to catalog the fauna and flora of the monarchy (Anonymous 1853; Punz 2001). As part of this initiative, the Society enriched the collections of the empire's schools by providing them with duplicates of specimens submitted free of charge by its members (Frauenfeld 1867; Lack 2006). In return, the Society received financial compensation from the Ministry of Education, highlighting the imperial endorsement of scientific collecting. These learned societies became vital embodiments of statehood and territoriality, amassing natural specimens from every corner of the empire, as later exemplified by the Vienna Natural History Museum.

The Zoological-Botanical Society, of which Bilimek was among the first board members, emerged as a significant forum for the study of cave biology (Christian 2003). Following the identification of a distinct subterranean fauna by Copenhagen zoologist Jørgen Schiødte (1815–1884) in 1849, based on specimens collected in Carniola, the Society's members expanded their investigations into the empire's underground animal world. The Society not only published information on newly discovered species in its journal but also served as a hub for the exchange of knowledge and

specimens through its monthly meetings. Expertise could compensate to some extent for a modest social background. For example, Prince Richard Khevenhüller-Metsch (1813–1877), the Society's first president, was officially represented by the ichthyologist Johann Heckel (1790–1857), the son of a music teacher and a warden in the imperial collections. Early on, large numbers of troglobites (species that live exclusively in caves) were collected by members of the Society, and numerous specimens were donated to the Vienna Imperial Collections and various provincial museums (Schiner 1854; Schmidt 1860; Wankel 1861).

Often, collectors such as Bilimek did not identify the new species themselves but entrusted this task to the curators of the Imperial Zoological Cabinet. Notable among these curators were the entomologists Vincenz Kollar (1797–1860) and Ludwig Redtenbacher (1814–1876) (Christian 2003). Such collaborations within the Society advanced the understanding and documentation of cave fauna significantly. This was important given the increasing nationalization of the monarchy's research landscape and the attendant professionalization of science, characterized by its emergence as a distinct occupation. In this context, the "unity" of the biological sciences, often emphasized at the Society's meetings, served as a significant symbolic gesture of cohesion, despite the increasing relevance of specialization in terms of day-to-day collaboration (Klemun 2001). Further, the meticulous lists of specimen donors published in the Society's journal aimed to highlight the mutual respect and recognition of both "professional" researchers with formal academic training and institutional affiliations, as well as "amateur" contributors such as dedicated naturalists and collectors.

The significance of subterranean zoology during the Society's two formative decades is illustrated by the president's regular reports of his excursions to Carniola. Prince Khevenhüller-Metsch, a dedicated ornithologist and collector, visited the caves near Postojna annually in the early 1850s, and documented his findings meticulously:

> On August 9th, I arrived in Adelsberg [Postojna] with all the equipment I deemed necessary for this expedition and promptly secured reliable guides. … We searched diligently until around five o'clock in the afternoon and discovered three exquisite specimens of *Leptodirus* in the canyons of Mount Calvary [in Postojnska jama]. … The *Leptodirus* appears to be nocturnal, as we predominantly found the beetles in the evening. Its habitat seems confined to Mount Calvary, where it moves slowly in the deepest gorges, undisturbed by visitors' torches, on very clean, damp stalactite walls that are not excessively wet. It likely also takes shelter in these cavities. Its natural adversaries include the *Obisium* [*Neobisium spelaeus*] and undoubtedly the eyeless cave spider *Stalita taenaria* [Schiødte, 1847]. … From this account, you will appreciate that I have diligently endeavored to explore every facet of organic life in this cave, and I may perhaps boast that few can match my wealth of results and experiences (Khevenhüller-Metsch 1851–1852: 106–109, 43, translated from German by me).

Khevenhüller-Metsch's hours spent crawling through crevices in search of troglobites were somewhat unconventional, given his high aristocratic status. Nonetheless, he shared his passion for entomology with members of the Habsburg family, notably

the abdicated Emperor Ferdinand (1793–1875), who commissioned artists to illustrate insects, including numerous cave specimens, in detail (Fig. 3). In addition to Khevenhüller-Metsch's deliberate "hunt" for *Leptodirus*, which was to be rediscovered in 1847 after a partially damaged specimen was found in 1832, he successfully collected the first specimen of *Bathysciotes khevenhuelleri* in Postojnska jama (Polak 2005). This cave beetle was to be later described by the coleopterist and ministerial official Ludwig Miller (1852), and an illustration appeared in the inaugural volume of the Society's journal (Fig. 4).

Ferdinand Josef Schmidt (1791–1878), a German-speaking merchant and collector based in Ljubljana, held a longstanding monopoly on the lucrative trade in cave insects (Polak 2005). Despite his lack of formal academic training, Schmidt acquired great expertise in coleopterans, capitalizing on his fluency in Slovenian and extensive knowledge of prime collecting sites. For years, German entomologists eagerly paid three Friedrichs d'or (the equivalent of 20 grams of gold) for each specimen of *Leptodirus hochenwartii* (Kraatz 1878). In the 1860s, Schmidt was succeeded by Nicolaus Hoffmann, a skilled cutler from Ljubljana, who collected and sold subterranean fauna on a large scale and at more affordable prices. Prompted by the improved transport links provided by the southern railway line from Vienna to Trieste, eminent members of the Zoological-Botanical Society, including President Khevenhüller-Metsch, Secretary General Georg Frauenfeld (1807–1873), and board members Alois Pokorny (1826–1886) and Ignaz Rudolf Schiner (1813–1873), would undertake extensive collecting trips to the karst areas around Postojna. They documented their new findings meticulously in the society's journal, thus contributing to understanding these still largely unknown ecosystems (Pokorny 1853; Schiner 1853; Frauenfeld 1854). Adolf Schmidl's participation in these joint trips culminated in Schiner's (1854) seminal article, wherein he classified cave fauna according to ecological criteria into troglobites, troglophiles, and occasional cavernicolous, classifications still used today, albeit with some modifications.

Until the early 1850s, apart from the blind fish *Amblyopsis spelaea* De Kay, 1842 and the trechine beetle *Neaphaenops tellkampfii* Erichson, 1844 from Mammoth Cave, Kentucky (Tellkampf 1844; Flack 2022), almost all known troglobites were discovered in the Habsburg monarchy, particularly in Carniola. This spurred growing efforts to locate cave specimens in other crown lands, such as Hungary, the Alpine region, and Moravia. Key collectors, for example, Janos Frivaldszky (1822–1895) from the Hungarian National Museum, the Viennese coleopterist Clemens Hampe (1802–1884), the Bohemian-born zoologist Camill(o) Heller (1823–1917), and the Blansko physician Heinrich Wankel (1821–1897), played major roles in documenting and describing new species from these regions. Their findings include the ground beetle *Duvalius* (*Biharotrechus*) *redtenbacheri* I. Frivaldszky von Frivald & J. Frivaldszky, 1857; the bathysciine *Pholeuon angusticolle* Hampe, 1856; the blind isopod *Mesoniscus alpicola* Heller, 1858; and the springtail *Arrhopalites pygmaeus* Wankel, 1860.

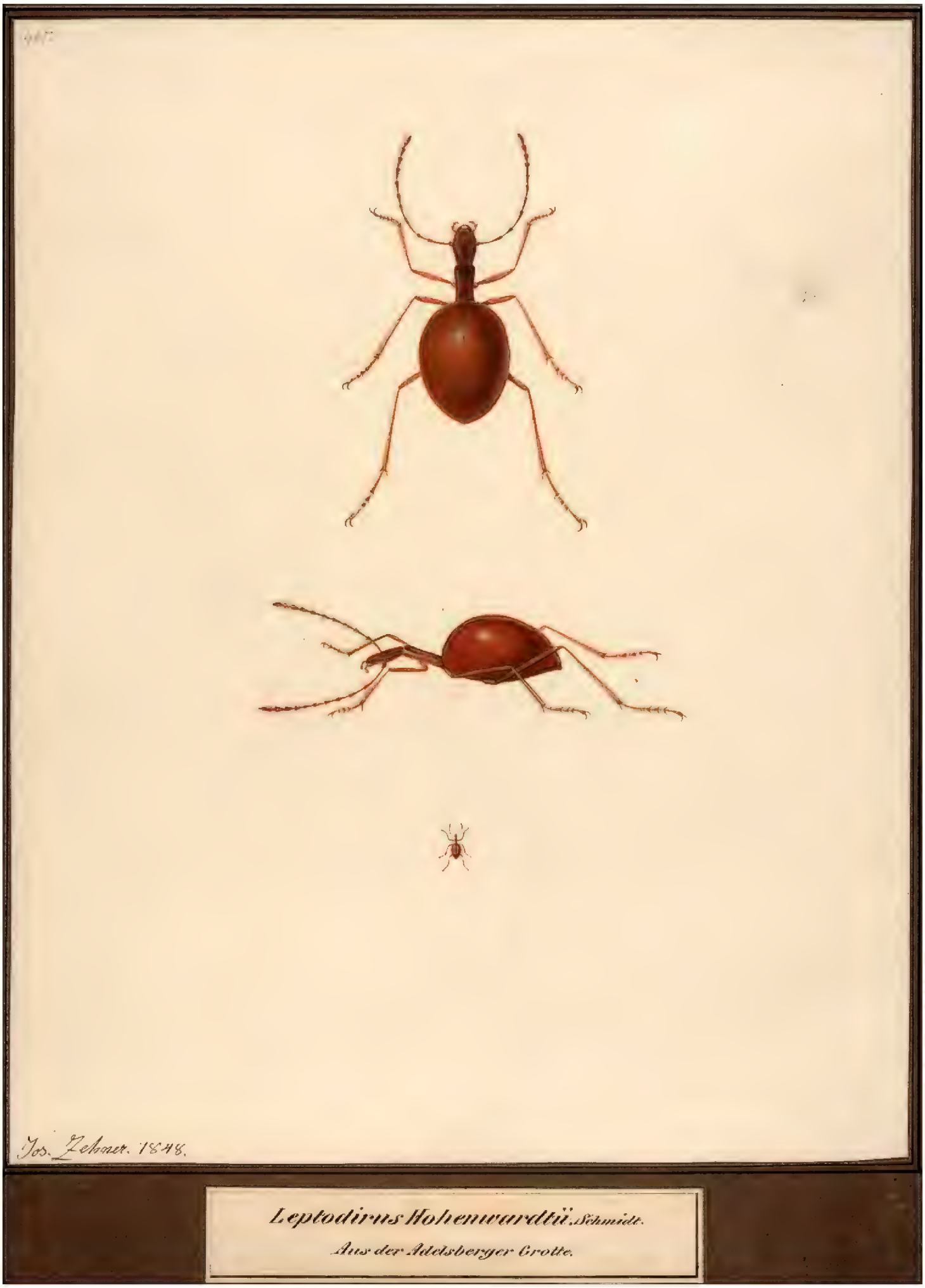

Figure 3. Drawing of the cave beetle *Leptodirus hochenwartii* in the art collection of Emperor Ferdinand of Habsburg, 1848. Artist: Joseph Zehner. Source: Austrian National Library, Bildarchiv (Pk 509, ZOOL32, 465).

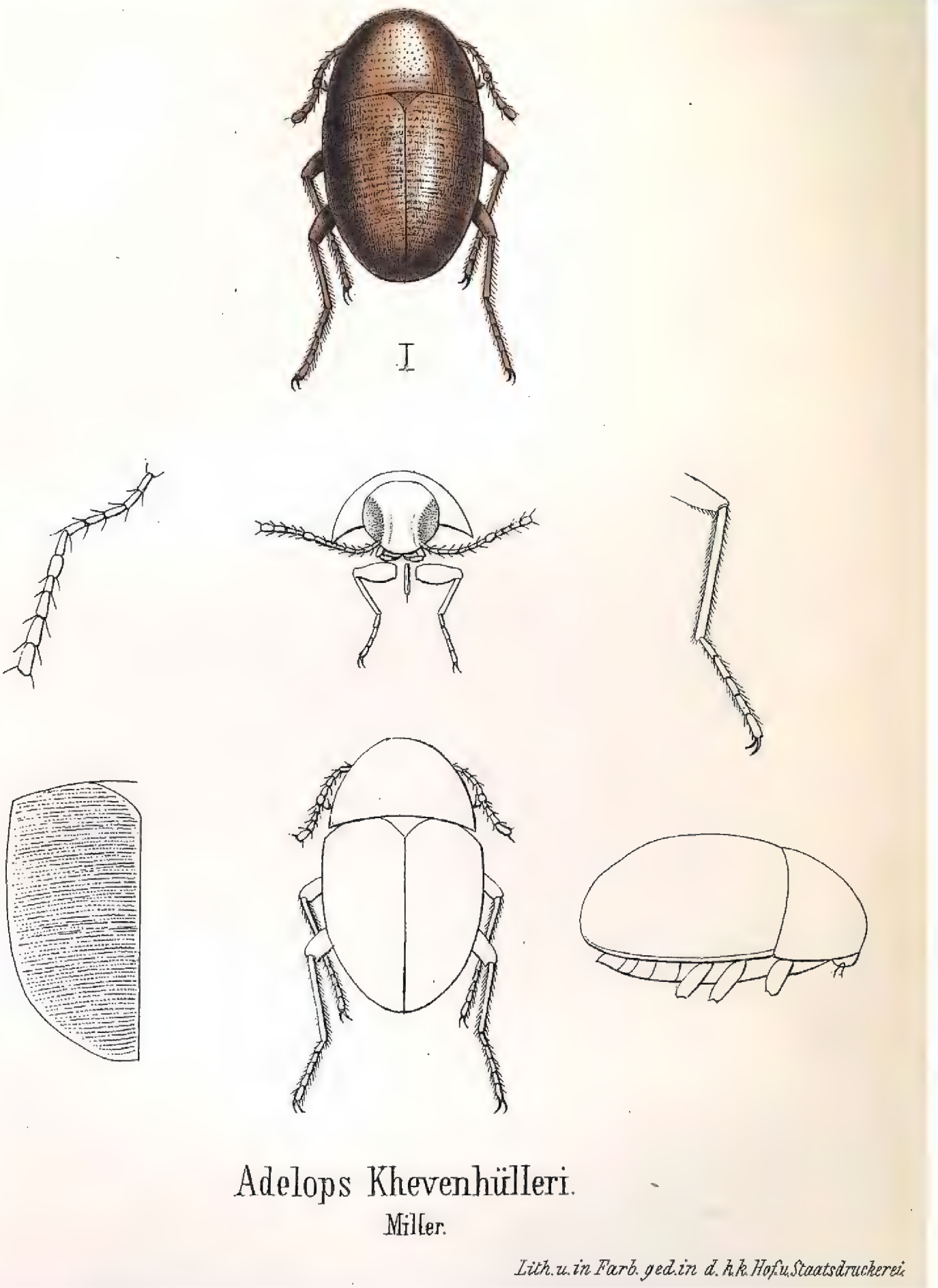

Figure 4. Drawing of the cave beetle *Bathysciotes khevenhuelleri* L. Miller, 1852. Source: Miller (1852, Tab. I).

The discovery and naming of new species held significant prestige and symbolic importance within the zoological–botanical community. Following nomenclatural conventions, the author who described and named the species is identified after the species name, while a specific epithet (the second part of the binomen) is often selected to

honor the discoverer or a prominent scholar. By immortalizing the names of researchers and their collaborators, this practice has been and continues to be essential for sharing scientific credit, thereby ensuring that contributors receive due recognition for their work. A lithograph by entomologist Ernst Heeger (1783–1866) (Fig. 5), published alongside Schiner's (1854) article in Schmidl's "Zur Höhlenkunde des Karstes" (On the Study of Caves in the Karst), illustrates various cave insects known to be from Carniola and the Habsburg monarchy at that time. This artificial arrangement of individual species that do not occur together naturally is only found in natural history collections. The symmetrical arrangement of the specimens on the lithograph can be interpreted as a visualization of the unity in diversity of the subterranean fauna. Additionally, four of the ten species are named after their finders or patrons of speleology. These individuals, along with the authors to whom both the name and the validating description were ascribed, symbolize the unity of biological research. In the Habsburg monarchy of the 1850s and 1860s, systematic zoology, particularly the study of cave fauna, was characterized by collaboration and mutual recognition between finders, patrons, and scientists.

Bilimek's visit to the Grutas de Cacahuamilpa and his comparative approach

In January 1866, Bilimek, accompanied by Wilhelm Knechtel (1837–1924), a Bohemian botanist and gardener at Chapultepec Castle, set out on a collecting trip from the Mexican emperor's country house in Cuernavaca. After a 70-kilometer journey, they finally arrived at the impressive entrance to the Grutas de Cacahuamilpa (Fig. 6). This cavern, long known to indigenous people, had become a popular destination since the 1830s among an array of travelers, artists, and politicians. Its distinguished visitors included Mexican President Ignacio Comonfort (1812–1863), who served from 1855 to 1858 (Uribe Salas and Valdivia Moreno 2015).

Although Bilimek (1867: 901) had been "assured from all sides that nothing was living in the cave," he succeeded in collecting eleven different species in a seven-hour exploration, which included the first known discovery of the cave silverfish *Anelpistina anophthalma*. Moreover, Bilimek observed that the Grutas de Cacahuamilpa were comparable in size, stalactite richness, and diversity of fauna to the famous Postojnska jama, establishing the former as a second "imperial" cave. This insightful comparison caught the attention of the Habsburg–Mexican imperial couple. Although Maximilian could not carry out his planned visit because of urgent political commitments, his wife Carlota of Mexico (1866: 3) visited the Grutas de Cacahuamilpa the same year. There, she inscribed her name, proudly recording that she had "written her name in a place more distant than the [inscription] of [former president] Comonfort," emphasizing her desire "not to let the empire be forgotten in this remote place."

Bilimek's rather sober account of his zoological expedition to the Grutas de Cacahuamilpa, presented to the Vienna Zoological-Botanical Society six months after Maximilian's death, was a significant milestone as it was possibly the first article on cave-dwelling

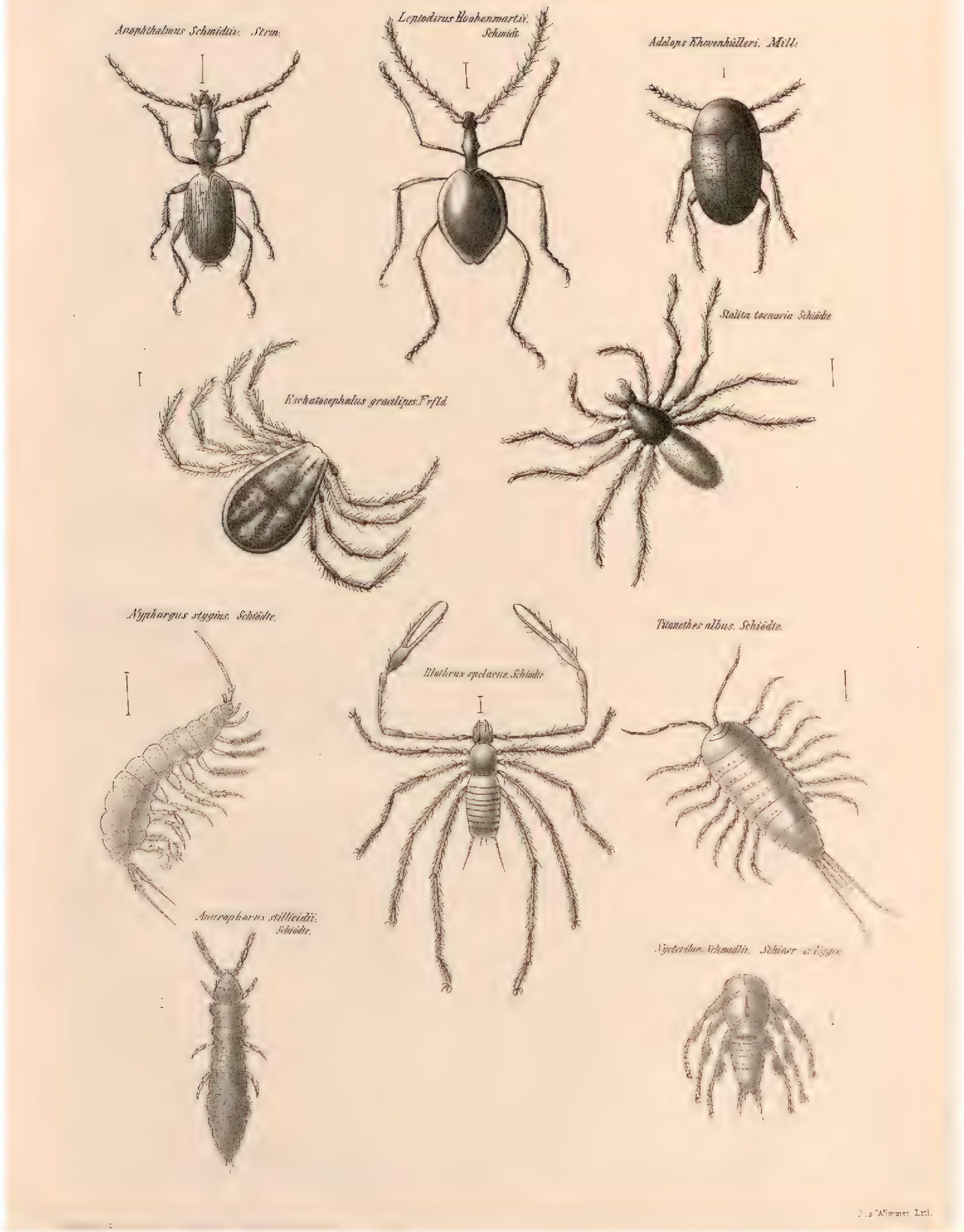

Figure 5. Iconography of the earliest known subterranean insect fauna. Artist: Ernst Heeger. Source: Schmidl (1854, Tab. 15), Austrian National Library, Bildarchiv (ALB Vues 08765).

organisms in the Americas outside the United States (Howarth 2023). Particularly noteworthy was his striking comparison with the renowned Postojnska jama, which served as an epilogue on the last page of his paper. Probably influenced by Khevenhüller-

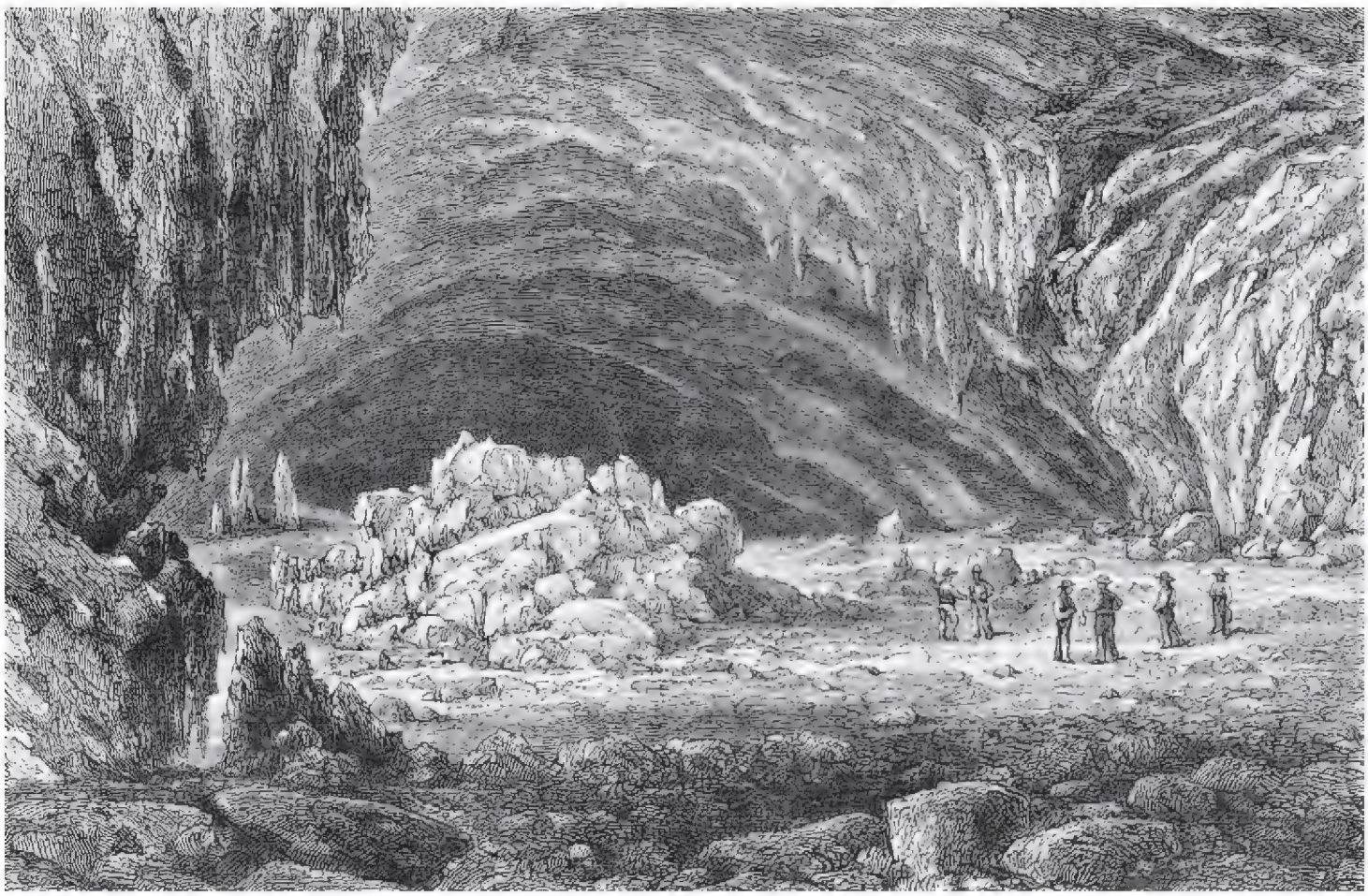

Figure 6. Entrance to the Grutas de Cacahuamilpa in Guerrero, Mexico. Source: Brocklehurst (1883, Tab. 38).

Metsch's (1850–1851) early ideas on the interconnectedness of cave fauna, Bilimek (1867: 908) noted the absence of "wingless flies" in the Grutas de Cacahuamilpa and attributed this to the lack of bats and the sparse number of visitors, resulting in insufficient "food and wood" entering the cave. This comparative analysis led Bilimek to argue that an ecological interdependence exists among the subterranean fauna, somewhat akin to a food chain model: "The presence of these species in the grotto," he contended, "is mutually conditioned." Beetles thrive on plant and animal matter, spiders prey on flies dependent on moisture, and woodlice and silverfish subsist on food particles in the cave soil. "As water reservoirs are known to be found deeper inside [the cave], it is likely that these are also inhabited." In his quest to find unity in diversity, Bilimek moved beyond collectors' individual observations to elucidate the co-existence of species as a symbiotic relationship, highlighting the intricate and interdependent nature of cave ecosystems.

Conclusion

This article examines the emergence of subterranean zoology as a research field in mid-nineteenth-century Central Europe, focusing on the multifaceted activities of Dominik Bilimek and his fellow collectors. While historical studies of biospeleology, often referring to Anglo-American and French scholarship, have examined major advances in species discovery and scientific thought, this paper centers on the sociopolitical frameworks that shaped early

understandings of cave fauna. Tracing the origins of cave entomology within the Habsburg monarchy has opened avenues for examining research practices in specific historical contexts, shedding light on imperial agendas and the interplay between science and society.

Mid-nineteenth-century studies of (cave) fauna differed methodologically from contemporary geoscientific fieldwork in its less coordinated and systematic approach, influenced by collectors' varying focuses and access to sites. Bilimek's visit to the Grutas de Cacahuamilpa exemplifies how such ventures, under individuals' own initiative, were nonetheless integrated into broader natural history inquiries. The collection, classification, and publication of findings involved multiple contributors and relied on transregional networks. While local stakeholders, supported by family members or hired indigenous workers, often captured and prepared the specimens, "professionals"—especially curators in Vienna or provincial capitals—subsequently documented these findings. The Vienna Zoological-Botanical Society was the sole association of its kind in Central and Southeastern Europe until the 1870s. It formalized these cooperative networks, facilitating the exchange of cave insect specimens and related knowledge, particularly concerning sites and environmental conditions. Furthermore, through its journal, the Society provided a platform for accrediting and internationalizing findings.

Thus, by exploring the social and political contexts of the emergence of subterranean zoology, I have highlighted the significance of lesser-known actors like Bilimek in producing, accumulating, and disseminating knowledge on cave fauna. However, their profile gradually diminished with the professionalization of research. Cooperation within these early networks relied on mutual recognition, evident through publications; the acknowledgment of both authors and finders in naming new specimens; and the prestige associated with private collections. Troglobites, valued for their scarcity and the exoticism of their habitats, occupied a prominent position in specimen circulation, which was driven by their purchase, exchange, or donation. Initiated by the discovery of *Leptodirus hochenwartii*, collecting cave insects became a fashion in mid-nineteenth-century Vienna that transcended class and political divisions. Empire-wide initiatives, aiming to pool sources and specimens from the crown lands and centralize them in Vienna, paved the way for the expansion of faunistic research from Carniola to the monarchy's other karst regions. Until the discovery of extensive fauna in Pyrenean caves by Charles Delarouzée (1857) and Charles Lespès (1857), the Habsburg monarchy's learned societies dominated the emerging field of cave entomology.

Overall, Bilimek's impact on early subterranean biology extends beyond the discovery of two species, which had placed him in the community of zoologists, naturalists, and collectors exploring the entomological "Eldorado" of the Carniolan caves in the 1840s and 1850s. The extensive geographical scope of his work, facilitated by his service to two empires, allowed for collecting specimens on a significant scale (and without ethical concerns). However, Bilimek's (1867) description of food chains in the Grutas de Cacahuamilpa and the Postojnska jama did not address the fundamental questions raised by Charles Darwin (1809–1882) in his recently published book "On the Origin of Species" (1859). Furthermore, Bilimek refrained from engaging in the heated debates on Darwin's theory that unfolded within the Vienna Zoological-Botanical Society

in the 1860s, which ultimately led to new advances in cave biology. Nevertheless, his contributions laid the groundwork for later European researchers to embark on collecting expeditions to the Americas, marking a significant, if complex, legacy.

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